

I. Amendments to the Claims

This listing will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

Claims 1-4 (Canceled)

Claim 5 (Previously presented): A piston pump including:
a cylindrical cylinder having a top portion;
a piston being formed in a cup shape with an outer peripheral surface and a cylindrical hollow portion inside, the piston reciprocating inside the cylinder as the outer peripheral surface slides directly on an inner wall of the cylinder;
a suction port through which gas is sucked into a pump chamber defined by a side of wall of the top portion of the cylinder, a side wall of the cylinder and a top face of the piston;
an exhaust port through which the gas is discharged from the pump chamber;
a recess portion disposed continuously around an inner wall of the cylindrical hollow portion of the piston in a circumferential direction of the piston;
a coupling ring having a projecting portion that fits on the recess portion such that the coupling ring engages with the piston wherein the cylindrical hollow portion communicates with a center portion of the coupling ring; and
a connecting ring connected to the coupling ring that transmits mechanical force from the connecting ring to the piston;

wherein the piston pump sucks the gas from the suction port and discharges the gas through the exhaust port as a volume of the pump chamber is changed by reciprocating motion of the piston;

wherein the suction port is arranged at the top portion of the cylinder with a suction valve, which opens when the volume of the pump chamber is increased; and the exhaust port is arranged at the piston with an exhaust valve, which is umbrella-shaped and is arranged outside the pump chamber and opens when the volume of the pump chamber is decreased, the piston having a hole at a center thereof in order to fix the exhaust valve; and

wherein an inner diameter of the cylinder is adaptedly formed not exceeding 20 mm.

Claims 6-12 (Canceled)

Claim 13 (Previously presented): A method of producing a piston pump including a cylindrical cylinder, a piston reciprocating inside the cylinder; a suction port through which gas is sucked into a pump chamber defined by the cylinder and the piston and an exhaust port through which the gas is discharged from the pump chamber; the method comprising the steps of:

producing a piston pump pre-assembly comprising the cylinder a cylinder top portion in which the exhaust port is formed, an exhaust valve fitted into a hole in the cylinder top portion so as to cover the exhaust port, and a manifold so that an air chamber is defined wherein the cylinder and the cylinder top are welded by ultrasonic welding and the cylinder top and the manifold are welded by ultrasonic welding so as to be air-tight;

conducting a leakage inspection of the air chamber of the piston pump pre-assembly by measuring a change of a pressure applied to the air chamber;

repairing or discarding the piston pump pre-assembly if it fails to pass the leakage inspection and proceeding with manufacturing the piston pump if the piston pump pre-assembly passes the leakage inspection;

fitting a valve into a hole on the top of the piston so as to cover the suction port thereon wherein the piston is formed in a cup shape with an outer peripheral surface and a cylindrical hollow portion inside which piston reciprocates inside the cylinder as the outer peripheral surface slides directly on an inner wall of the cylinder;

press-fitting a coupling ring into a recess disposed continuously around an inner wall of the cylindrical hollow portion in a circumferential direction of the piston such that a projection portion of the coupling ring fits on the recess portion such that the coupling ring engages with the piston wherein the cylindrical hollow portion communicates with a center portion of the coupling ring wherein a connecting ring is integrally formed with the coupling ring;

press-fitting a crank shaft so a driving shaft of a motor;

inserting the crank shaft into the connecting ring so that a piston-cam-motor sub-assembly is assembled; and

inserting the piston of the piston-cam-motor sub-assembly into the cylinder of the piston pump pre-assembly so as to produce a piston pump.

Claims 14-18 (Canceled)

Claim 19 (New): The piston pump according to claim 5, wherein the suction valve is umbrella-shaped and arranged inside the pump chamber.